APPENDIX J

SUPPORTING INFORMATION FOR WATER RESOURCES

WATER RESOURCES

WATER RESOURCE DESCRIPTIONS

Wetlands

As discussed in Chapter 3, the National Wetlands Inventory Classification for Wetlands (Cowardin, 1979) describes wetland habitats according to a hierarchical classification system progressing from System and Subsystem, at the general level, to Classes and Subclasses (where applicable). A System refers to a complex of wetlands and deepwater habitats that share the influence of similar factors such as, hydrologic and geomorphic features, and chemical and biological characteristics. This classification system describes ecological taxa and provides uniformed concepts and terms.

There are five wetland categories in this classification system:

- ***Estuarine*** - Deepwater tidal habitats and adjacent tidal wetlands that are usually semi-enclosed by land but have open, partly obstructed, or sporadic access to the ocean, with ocean water at least occasionally diluted by freshwater runoff from the land. The upstream and landward limit is where ocean derived salts measure less than .5 parts per thousand during the period of average annual low flow. The seaward limit is (1) an imaginary line closing the mouth of a river, bay, or sound, and (2) the seaward limit of wetland emergents, shrubs, or trees when not included in (1).

- ***Riverine*** - All wetlands and deepwater habitats contained within a channel except those wetlands (1) dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens, and (2) which have habitats with ocean-derived salinities in excess of .5 parts per thousand.

- ***Lacustrine*** - Wetlands and deepwater habitats (1) situated in a topographic depression or dammed river channel, (2) lacking trees, shrubs, persistent emergents, emergent mosses, or lichens with greater than 30 percent areal coverage, and (3) whose total area exceeds 8 hectares (20 acres), or area less than 8 hectares if the boundary is active wave-formed or bedrock or if water depth in the deepest part of the basin exceeds 2 meters (6.6 feet) at low water. Ocean-derived salinities are always less than .5 parts per thousand.

- ***Palustrine*** - All nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens, and all such tidal wetlands where ocean-derived salinities are below .5 ppt. This category also includes wetlands lacking such vegetation but with all of the following characteristics: (1) area less than 8 ha, (2) lacking an active wave-formed or bedrock boundary, (3) water depth in the deepest part of the basin less than 2 m (6.6 ft) at low water, and (4) ocean-derived salinities less than .5 parts per thousand.

- ***Marine*** - Open ocean overlying the continental shelf and coastline exposed to waves and currents of the open ocean shoreward to (1) extreme high water of spring tides,

(2) seaward limit of wetland emergents, trees, or shrubs, or (3) the seaward limit of the Estuarine System, other than vegetation. Salinities exceed 30 parts per thousand.

A more comprehensive discussion of wetlands can be found in Appendix I.

Floodplains

Floodplains are lowland areas adjacent to surface water bodies (i.e., lakes, wetlands and rivers) that are periodically covered by water during flooding events, and can carry and store floodwaters during these flood events. Floodplains are any areas of land susceptible to inundation by floodwaters from any source. A 100-year floodplain differs in that it is an area adjoining a river, stream, or other waterway that is covered by water in the event of a 100-year flood. A 100-year flood is a flood having a one percent chance of being equaled or exceeded in magnitude in any given year. The 100-year floodplain is considered a Wetland Resource Area under the Wetlands Protection Act.

The 100-year-frequency flood (or base flood) is one with a probability of occurring once every hundred years, meaning it has a one-in-one-hundred or one percent chance of being equaled or exceeded in any year. A 500-year frequency flood is one with a probability of occurring once every five hundred years, having a one-in-five-hundred or 0.2 percent chance of being equaled or exceeded in any year. A 50-year frequency flood has a one-in-fifty or two percent chance of occurring within any year. Although all of these frequencies may be considered in the design of development in an area prone to flooding, the 100-year frequency flood is the one serving as the standard for most regulations. The height reached by water in a base flood or 100-year frequency flood is called the base flood elevation. Water may rise above this level during a flood, but that is the official regulatory flood stage.

Executive Order (EO) 11988, Floodplain Management (1977, 42 FR 26951), requires federal agencies to avoid adverse impacts associated with the occupancy and modification of floodplains and to avoid floodplain development whenever possible. Additionally, EO 11988 requires federal agencies to make every effort to reduce the risk of flood loss, minimize the impact of floods on human health, safety, and welfare, and preserve the natural beneficial value of floodplains.

EO 11990, Protection of Wetlands (24 May 1977, 42 FR 26961), places additional requirements on floodplains when considered as wetlands. The EO requires federal agencies to avoid undertaking or providing assistance for new construction located in wetlands unless there is no practicable alternative, and all practicable measures to minimize harm to wetlands have been implemented. Also, the EO precludes federal entities from leasing space in wetland areas unless there are no practicable alternatives.

Parts of the floodplain that are also considered wetlands will, in addition to floodplain zonings, receive protection from federal, state and local wetland laws. These laws, such as the U.S. Army Corps of Engineers section 404 Permit Program, regulate alterations to wetlands to preserve both the amount and integrity of the nation's remaining wetland resources.

Floodplains and riparian habitat are biologically unique and highly diverse ecosystems providing a rich diversity of aquatic and terrestrial species, acting as a functional part of natural systems. River corridors are frequently used as flyways for migrating birds, and floodplain vegetation provides important resting, feeding, and nesting areas for many waterfowl species. However, fragmentation of continuous natural areas reduces their appeal and function for a wide variety of wildlife species. Floodplains also provide habitat for microbiotic organisms and plants that can biodegrade some toxic chemicals and pesticides, while floodplain vegetation and natural river channels regulate in-stream temperatures to maintain an adequate environment for fish and other river life. Floodplains also provide protective refuge areas for fish during floods.

Floodplain vegetation and soils act as water filters, intercepting surface water runoff before it reaches lakes, streams, or rivers. This process aids in the removal of excess nutrients, pollutants, and sediments from the water and helps reduce the need for costly cleanups and sediment removal. Floodplains also reduce downstream flooding by increasing upstream storage in wetlands, sloughs, back channels, side channels, and former channels.

Florida Water Body Classifications

Class	Designation	Water Body Type	Characteristics
I	Drinking Water	Usually Lakes or reservoirs	
II	Shellfish Harvesting	Estuaries	
III – Freshwater	Wildlife and Recreation		
III – Marine			Chloride > 1,500ppm
IV	Agriculture		
V	Industrial		

Source: FDEP, 2004

WATER RESOURCE REGULATIONS

Clean Water Act

Section 401 of the Clean Water Act

In 1972, Congress passed the Federal Water Pollution Control Act Amendments, also known as the Clean Water Act (CWA). Section 401 of the CWA, gives states the authority to grant, deny, or condition issuance of federal permits that may result in a discharge to waters of the United States, including the discharge of dredged or fill material under the State Water Quality Certification process. Through the 401 certification process, states can prevent noncompliance with water quality standards through permit denials or conditions of permit issuance (i.e., mitigation requirements). The U.S. Environmental Protection Agency (USEPA) encourages states to use 401 certification as a means of protecting wetlands and offsetting unavoidable impacts by obtaining mitigation proposals before granting 401 certification.

The Florida Department of Environmental Protection (FDEP) administers a program called the Environmental Resource Permit program under Part IV, Florida Statutes Section 373, which includes wetlands regulations. Florida's wetland program regulates dredge and fill activities in both fresh and salt waters under their jurisdiction. Jurisdictional waters include surface waters that are present all year and are greater than 10 acres at a minimum average depth of two feet existing throughout the year, and permanent flowing streams and tributaries. Waters adjoining Florida's coastline are also under the state's jurisdiction.

Section 402 of Clean Water Act

In 1972, the CWA was amended to provide that the discharge of any pollutant to waters of the United States from any point source is unlawful without a National Pollution Discharge Elimination System (NPDES) permit (Section 403.0885, Florida Statutes). The program aims to control water pollution by regulating point sources that discharge pollutants into waters of the State of Florida from certain municipal, industrial, and construction activities. Section 402 of the CWA advocates the use of best management practices (BMPs) to minimize or eliminate the introduction of stormwater pollutants into waters of the United States.

The total land disturbance (i.e. impervious surface, land clearing/grading/excavating) created as a result of construction/demolition activities and related infrastructure will exceed one acre and will therefore require that the Proponent file a NPDES permit application (with associated requirements and fees) prior to any construction. This program is independent of Florida's environmental resource permitting programs (found under Part IV, Chapter 373, F.S. and Chapter 62-25, F.A.C.).

Section 404 of the Clean Water Act

Section 404 of the CWA aims "to restore and maintain the chemical, physical, and biological integrity" of the nation's waters. Section 404 of the CWA requires a permit from the U.S. Army Corps of Engineers (USACE) and authorized state agency (FDEP) for the discharge of dredged or fill material into the waters of the United States, including wetlands. The potential for Section 404 permitting action under the CWA exists because of the proximity of the construction project to area wetlands.

Rivers and Harbors Act of 1899

The legal authority for the U.S. Army Corps of Engineers' permit process is derived from Section 10 of the River and Harbor Act. The Act requires authorization from the Secretary of the Army, acting through the U.S. Army Corps of Engineers (USACE), for the construction of any structure in or over any navigable water of the United States. The law applies to any dredging or disposal of dredged materials, excavation, filling, re-channelization, or any other modification of a navigable water of the United States, and applies to all structures, including the residential, commercial, and governmental boat dock and piers.

EO 11990, Protection of Wetlands

Under EO 11990, *Protection of Wetlands* (1977, 42 Fed. Reg. 26961), federal agencies are prohibited from undertaking or providing assistance for activities, including new construction, located in wetlands unless there are no practicable alternatives and all practicable measures to minimize harm to wetlands have been implemented. It also precludes federal entities from leasing space in wetland areas unless there are no practicable alternatives. Wetlands on federal lands are further protected under EO which states "...each federal agency shall provide leadership and shall take action to minimize the destruction, loss or degradation of wetlands...."

EO 11988, Floodplain Management

Under Executive Order (EO) 11988, *Floodplain Management* (1977, 42 Fed. Reg. 26951), federal agencies are prohibited from the occupancy and modification of floodplains and floodplain development unless there is no practicable alternative. The EO also requires federal agencies to make every effort to reduce the risk of flood loss, minimize the impact of floods on human health, safety, and welfare, and preserve the natural beneficial value of floodplains. The EO stipulates that federal agencies proposing actions in floodplains consider alternative actions to avoid adverse effects, avoid incompatible development in the floodplains, and provide opportunity for early public review of any plans or proposals. If adverse effects are unavoidable, the proponent must include mitigation measures in the action to minimize impacts.

Given these EO requirements, the FDEP wetland data and Federal Emergency Management Agency (FEMA) floodplain data were added to the GIS and included in this report.

Parts of the floodplain that are also considered wetlands will, in addition to floodplain zonings, receive protection from federal, state, and local wetland laws. These laws, such as the USACE regulates section 404 Permit Program, regulate alterations to wetlands to preserve both the quantity and quality of the nation's remaining wetland resources under Executive Order 11990, Protection of Wetlands.

Safe Drinking Water Act

In 1974, the Safe Drinking Water Act (SDWA) was passed with several amended since then to expand the authority of U.S. Environmental Protection Agency's enforcement. This regulatory authority was later passed on to individual states and now the USEPA serves only to supervise the state-approved programs. The primary purpose of the SDWA is to stop organic chemicals from entering drinking water systems. The Act strives to accomplish this by establishing water quality standards for drinking water, monitoring public water systems, and guarding against groundwater contamination from injection wells (42 United States Code §§ 300f -300j-26).

Watershed Protection and Flood Protection Act

The Watershed Protection and Flood Protection Act (16 U.S.C. §§ 1001-1009), and its subsequent amendments, authorizes federal assistance for planning and carrying out projects in watershed areas for conservation and use of land and water, and flood prevention. The Act is intended to preserve, protect, and improve terrestrial and aquatic resources.

North American Wetlands Conservation Act

Under the North American Wetlands Conservation Act (16 U.S.C. §§ 4401-4414) Wetlands are afforded protection in order to maintain "healthy populations of migratory birds in North America." Under this legislation, the Act holds that wetland ecosystems provide "essential and significant habitat for fish, shellfish, and other wildlife of commercial, recreational, scientific, and aesthetic values."

Coastal Wetlands Protection Act

The Coastal Wetlands Protection Act (CWPA) aims to preserve the natural state of the coastal wetland ecosystems and to prevent destruction of these areas that are not designed to serve a higher public interest. The CWPA provides additional authority to protect tidal wetlands.

<u>Dock Construction Guidelines in Florida for Docks or Other Minor Structures</u>

Constructed in or over SAVs (Guidelines in for Docks in SAVs)

The National Marine Fisheries Service, the U.S. Fish and Wildlife Service, the U.S. Army Corps of Engineers, and the Florida Department of Environmental Protection developed construction guidelines for docks and other minor structures in areas that support SAVs in Florida.

WATER RESOURCES IMPACT ANALYSIS

Impervious Surface Estimates

Current amounts of impervious surface at all proposed demolition and construction sites were estimated using Geographic Information Systems (GIS) coverages. The impervious surface classification at the existing and proposed MFH areas was derived from a 15JAN2003 Landsat Enhanced Thematic Mapper satellite imagery (15-30m resolution). An unsupervised classification technique was used to select natural groupings of pixels with similar characteristics. Urban/developed areas were extracted from the groupings derived from the unsupervised classification to produce a GIS coverage depicting areas that contain impervious surfaces. Acreages and percentages were tabulated using the GIS areas of interest and the derived image classification. Estimates are shown in Table 4-18 in Section 4.7.

Stormwater Runoff Peak Flow Analyses

There are several different methods available for determining stormwater runoff peak flows. Two of the most widely used methods are the Rational Method and the Soil Conservation Service (SCS) Method. The Rational Method determines a peak runoff discharge rate by using a factor that quantifies the runoff potential for the area, the maximum rainfall intensity for the location and the total land area, as shown in the equation below (FDEP, 2002).

$q = 0.0028\ CiA$
C = runoff coefficient
i = rainfall intensity for a duration equal to time of concentration (in/hr)
A = watershed area in acres

The SCS method classifies land use and soil type with one parameter, Curve Number (CN), and then calculates runoff through a series of equations. The United States Department of Agriculture (USDA), SCS Technical Release 55 (TR-55) Urban Hydrology for Small Watersheds was first issued in January 1975 as a simplified procedure to calculate the storm runoff volume, peak rate of discharge, hydrographs and storage volumes required for storm water management structures. The SCS method is recommended for areas with greater than 10 percent urbanization. In comparison to the Rational Method, the SCS equations may under-predict runoff volume from most small storms. This is because the CN values used in the SCS method assume that runoff will only occur once the soil has become saturated (FDEP, no date).

There are many variations in interpretation and methodology of calculating stormwater runoff. The SCS method is an accepted method to calculate runoff from urban sites and it was determined that a model based on the SCS method would provide data effective in evaluating stormwater runoff rates and volumes from existing and proposed housing development areas involved in Housing Privatization. The model chosen is the Natural Resources Conservation Service (NRCS) WinTR-55 and is a single-event rainfall-runoff small watershed hydrologic model based on the USDA, SCS TR-55. The model allows great flexibility in subdividing watershed areas, calculating combined CN values based on the multiple land uses and soil types for one location and providing calculations of other necessary parameters.

Evaluation. The WinTR-55 model and User Manual NRCS Version Date: 19, 2002 were downloaded from the NRCS website (http://www.wcc.nrcs.usda.gov/hydro/hydro-tools-models-wintr55.html). The maximum area for the model is 25 mi^2, which is sufficient for the Housing Privatization areas, and the rainfall distributions include NRCS Type I, IA, II, III, NM 60, NM65, NM70, NM75, or user-defined. The Rainfall duration of the model is 24 hours and the primary inputs needed to run WinTR-55 are the drainage area, CN, and Time of Concentration (T_c).

Rainfall. Typical stormwater system design considerations for the County evaluate the peak discharge for 25-year storms for multiple durations ranging from 1 hour to 24 hours. This accounts for variations in soil types and accompanying percolation rates. Soils with good percolation rates may experience peak runoff rates during shorter, more intense storms and soils with poor percolation rates may experience peak flows during longer storms with greater total rainfall amounts. The WinTR-55 model provides Type III rain data for Okaloosa County; however, the rain data is only for a 24-hour duration. It was decided that a 25-year storm was the appropriate frequency storm to evaluate runoff volume for existing and proposed housing sites based on the County's requirements. A 24-hour duration event was acceptable due to the predominance of sandy, well draining soils at the housing area locations. A 25-year/24-hour storm event is one that theoretically occurs once every twenty-five years and lasts for 24 hours. This type of rain event yields 10.23 inches of rain in Okaloosa County, Florida.

Land Areas. The land areas for each housing location were identified on United States Geological Survey (USGS) Topographical maps and were divided into drainage areas based on the area contours. To determine housing acreages, the total number of housing units at a site was divided by 3 (maximum of 3 housing units/acre). In order to determine an average for the miles of roads per acre for MFH on Eglin, GIS coverage of the current Old Plew/New Plew Housing Area was selected and road mileage and acreage for the area were determined. The miles of road within the Old Plew/New Plew Housing Area (4.76 miles) was divided by the acres in the area (224 acres) to determine an average for the miles of roads per acre (0.019 miles of road/acre, or 100.3 ft/acre). Next, to calculate the area of impervious road surface, this average (100.3 ft of roads/acre) was multiplied by the minimum required width of roads in the new developments (24 feet) to get the square footage of roads/acre of land (2407 sq ft roads/acre). Then, this road square footage was multiplied by the acreage of each expansion area (varies) for the square footage of roads for each expansion area. Since some areas (i.e., wetlands) will not be developed within certain areas, this method of estimation inherently overestimates road coverage, but it should only be a small amount.

Land Use. As previously stated, the CN parameter quantifies the runoff potential for an area based on land use and soil type. The Hydrologic Soil Groups (HSG) A, B, C, and D identify the soil type. A is considered very pervious with low runoff potential and D is not pervious with a high runoff potential. For example, a sandy soil would be in group A and a clayey soil would be in group D (Lindeburg, 1999). Figures J-1 and J-2 identify the HSG for the housing sites.

Areas calculated from the maps shown in Figures J-1 and J-2 were used to determine the area of a particular soil type at a site. Table J-1 lists the CN values used during this evaluation, depending upon the soil type. It was assumed that the three cover types at each location would be paved streets, residential lots, and woods. Existing residential lots were assumed to be 1/3 acre (30 percent impervious) based on an overall estimate of 3 housing units/acre. Housing unit densities of 3 units/acre (30 percent impervious), 4 units/acre (38% impervious) and 6 units/acre were evaluated for the proposed new developments. The WinTR-55 model does not provide a CN value for residential lots with a 6 units/acre density. This potential Housing Privatization density is proposed for the development of townhouse units, therefore, the default WinTR-55 CN value for townhouses, 8 units/acre (65% impervious), is used as a reasonable estimate for a housing density of 6 units/acres. Woods in good condition were assumed to be the existing condition for undeveloped areas and the undisturbed areas in the developed areas.

Table J-1. Runoff Curve Numbers

Runoff Curve Numbers of Urban Areas (TR-55)					
Cover Description		**Curve Numbers for Hydrologic Soils**			
Cover type and Hydrologic Condition	**Average % Impervious Area**	**Group A**	**Group B**	**Group C**	**Group D**
Paved streets and roads with curb and storm sewers		98	98	98	98
Residential districts by average lot size (1/3 acre)	30	57	72	81	86
Residential districts by average lot size (1/4 acre)	38	61	75	83	87
Residential districts by average lot size (1/8 acre; townhouses)	65	77	85	90	92
Woods (good condition)		30	55	70	77

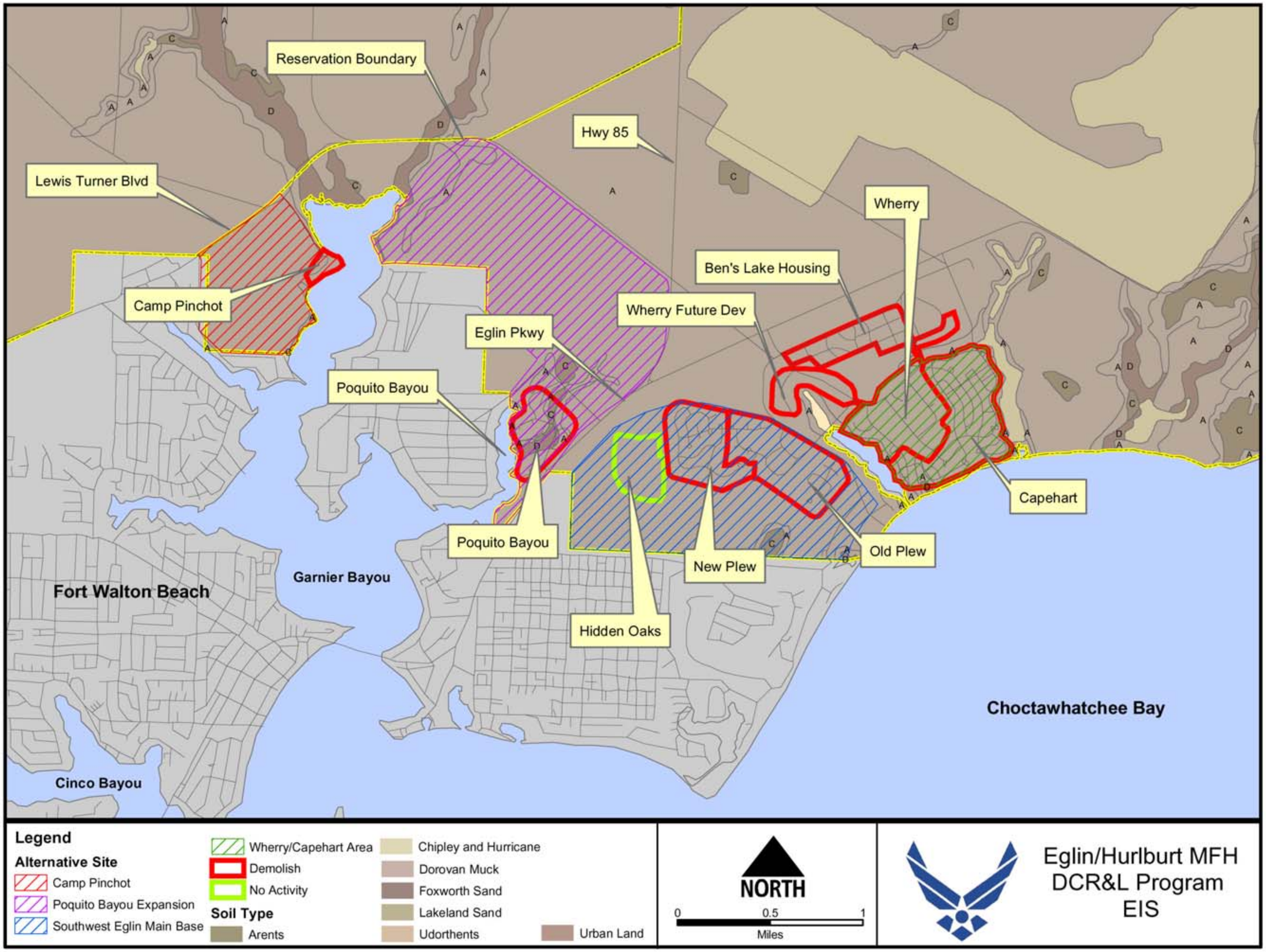

Figure J-1. Eglin AFB Hydrologic Soil Groups

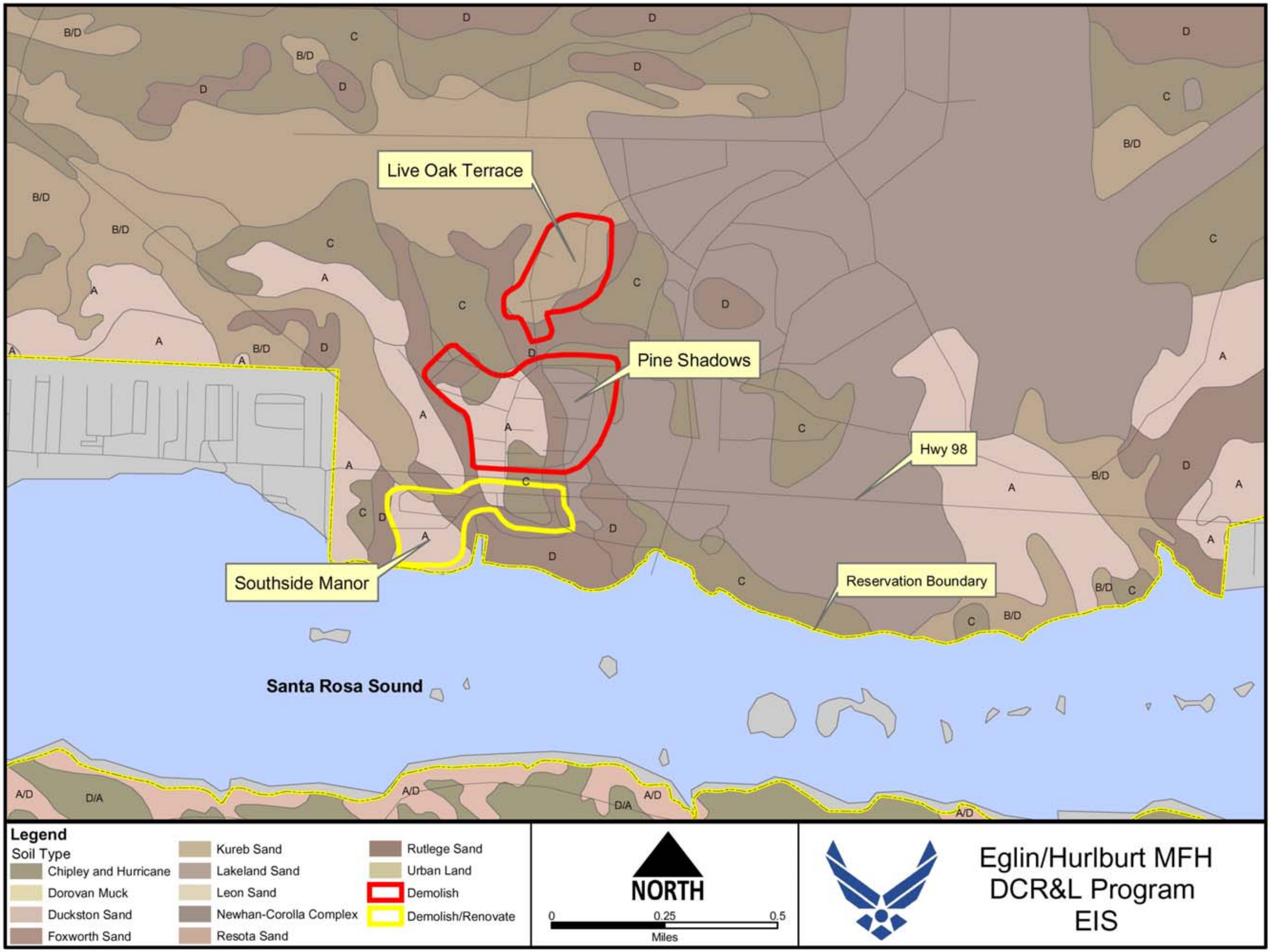

Figure J-2. Hurlburt Hydrologic Soil Groups

Time of Concentration (T_c). The T_c is the length of time it takes for water to flow from the most remote point of the area to the outlet once the soil has become saturated. After a maximum of 300 feet, sheet flow usually becomes shallow concentrated flow. However, no detailed site information is available for the housing sites so all flow is to be assumed to be shallow concentrated. The WinTR-55 model requires the input of flow length, slope, and a flow path designation of paved or unpaved to calculate T_c. Based upon the designation of paved or unpaved, Manning's number is determined and flow velocity is calculated. The percent impervious for a watershed is determined by dividing the total acres of impervious surface (percent impervious housing acres combined with the street acres) by the total acres. The percent impervious for housing is 30%, 38%, or 65%; depending upon the housing unit density evaluated. The calculated percent impervious is then multiplied by the flow length to determine paved flow length when calculating T_c. WinTR-55 uses the 2 year 24-hour rainfall to determine T_c. For Okaloosa County, Florida, using a Type III distribution yields a rainfall amount of 6 inches.

The distance from the most remote point to the outlet was determined on the USGS Topographical maps depicting the drainage areas for each housing site. An approximation of the slope was then calculated using the contours on the maps.

Following are the equations used by WinTR-55 in the determination of T_c.

Shallow Concentrated flow

V=16.1345*S^0.5 for unpaved
Based on solution of manning equation with n=0.05 and r=0.4
V=20.3282 S^0.5 for paved
Based on solution of manning equation with n=0.025 and r=0.2

Where V=average velocity (ft/s)
S=slope of hydraulic grade line (watercourse slope ft/ft)
Tc = L/(V x 3600)
Where T_c = Time of concentration (hrs)
L = length of flow (ft)

Results

Once the rainfall, land area and use, and T_c data are entered, WinTR-55 is run to yield the peak discharge flow of stormwater runoff in cubic feet per second (cfs). Additionally, a TR-20 report can be run to determine the total amount of runoff for the area in inches. Following is an example of the methodology followed and data entered for one of the housing sites, the Camp Pinchot Expansion site (Alternatives 4, 5, 6, and 7) with a housing unit density of 3 units/acre.

The boundaries of the site were identified on the USGS Topographical map for Fort Walton Beach, Florida. Based on the contours within the boundaries of the area, it was assumed that there was only one drainage area for the site. The total land acres for the proposed site is given as 220 acres with the entire area comprised of 0.33 acre lots and an estimated 12 acres of roads. The existing site contains 12 acres of houses and an estimated 1 acre of roads. The appropriate acreages were then entered in the land use section to determine the combined CN, as shown in Table J-2.

Table J-2. Land Use and Combined CN for Camp Pinchot Alternatives 4, 5, 6, and 7

Land Use/Combined CN				
	Housing	Road Acres	Wood Acres	Combined CN
HSG	A		A	
Existing (Acres/CN)	1/57	1/98	218/30	30
Proposed (Acres/CN)	208/57	12/98	0	59

The T_c was then determined by first measuring the distance from the most remote portion of the property to the drainage outlet using the USGS Topographical map. For the Camp Pinchot site this length of flow was found to be approximately 3,000 feet. The elevation drop was then calculated based on the map contours. Dividing the elevation drop by the length of flow yielded a slope of 0.012 ft/ft. As previously stated, shallow concentrated flow was assumed for all of the drainage areas. For the existing site 99 % of the length of flow was calculated to be unpaved. However, the proposed site was assumed to have a length of flow with 34 percent impervious surface based 30 percent impervious for the housing acres [((0.3) x 208 acres)/220 acres]. Accordingly, 1,015 feet of the length of flow was designated as paved and the remaining 1,985 feet of length of flow was designated as unpaved.

The 25-year, 24-hour storm event was then selected and WinTR-55 was run. The model yielded peak flows of 94.34 cfs and 774.18 cfs for the existing and proposed conditions, respectively. Additionally, the TR-20 report yielded total runoff amounts of 1.08 inches and 4.96 inches for the existing and proposed conditions, respectively.

Finally, assuming a maximum retention requirement of a one-inch of rainfall at the site, the necessary storage capacity was calculated by multiplying the acreage of developed land by one inch. The result was then converted to cubic feet (ft^3) to yield 7,260 ft^3 and 889,352 ft^3 for the existing and proposed sites, respectively.

Results for the Camp Pinchot Expansion site along with the other housing sites are presented in Tables 4-18 and 4-19 in Section 4.7.

As evident in Table 4-18, when the developed acreage increases at a site there is an accompanying increase in both the stormwater peak discharge rate and the total runoff volume at each site. For example, Drainage Area 1 in the Poquito Bayou expansion Alternative 1 has an estimated peak discharge rate increase from 104.71 cfs to 671.55 cfs and a total runoff increase from 1.08 inches to 4.00 inches. As previously stated, the design for a site with this type of projected increase would include BMPs to lower the peak discharge rate for the developed area to the pre-development rate. In the case of sites with proposed development within the already developed areas, the impact is minimal. For example, the Soundside Manor expansion has an estimated peak discharge rate increase from 127.28 cfs to 137.52 cfs and a total runoff increase from 4.55 inches to 4.82 inches.

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